APPENDIX I

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A PALAEOBOTANICAL STUDY OF THE WIJSTER SETTLEMENT

The palaeobotanical investigation of the Wijster settlement comprises the following aspects:

1. Wood identification of a number of objects. The results of the identifications have been mentioned by Van Es in the description of the objects concerned, and they will not be repeated here.[1]
2. Palynological investigation of a number of soil samples.
3. The investigation of a sample of carbonized grain (find no. 1239).

A. PALYNOLOGICAL INVESTIGATION

The following samples have been studied palynologically:

I. Humous layer (A-1 horizon) of a heather podzol profile which was covered by drift sand (Section A1, Fig. 5). Sample I must be older than the beginning of the settlement, since the latter was situated on top of the drift sand.

II. Humous layer (A-1 horizon) of a podzol profile, above which a layer of arable soil was present (Section C, Fig. 5). The old arable was cut by a foundation trench of the settlement.

III. Spade mark from the westernmost field (Fig. 181, III).

IV. Spade mark from the easternmost field (Fig. 181, IV).

V. Humous layer on top of arable soil which must be younger than the settlement, as it cuts through post holes of the latter (Section C, Fig. 5).

VI. Humous layer on top of arable soil (Section F, Fig. 5). In Section F, which cuts across the fields mentioned above, the spade marks could be observed at the basis of the old arable. In the old arable a distinction could be made, at least locally, between the lower layer to which the spade marks belong, and an upper layer which must be correlated stratigraphically with the old arable of sample V. Sample VI was from the top of the upper layer.

The results of the palynological investigation are represented in Table II. The values for the various pollen types are traditionally expressed as percentages of the tree pollen sum.

The heather podzol profile of sample I corresponds stratigraphically with the blown-over podzol which could be observed below the burial mounds on the Emelange, *ca.* 500 m. east of the Wijster settlement.[2] Consequently, the spectrum of sample I agrees well with both spectra of the lower podzol on the Emelange.[3] Only the *Quercus* (oak) percentage in sample I is lower than that in the corresponding Emelange spectra, but this can be the effect of a difference in pollen preservation.[4] Sample I has been analysed in order to serve as a basis for comparison with the stratigraphically younger samples.

As the position of sample II with respect to the settlement does not appear clearly from the section, sample III which undoubtedly belongs to the settlement will be discussed first. It would be logical to discuss samples III and IV, both from spade marks in fields from the last period of the settlement, together. However, as the pollen contents of sample IV must be considered to be abnormal to some degree, discussion of this sample will be postponed until later.

A comparison between samples I and III shows that in spectrum III the *Corylus* (hazel) percentage is lower and that for *Fagus* (beech) markedly higher than in spectrum I. Also the herbaceous percentages show considerable differences in both samples. In sample I *Calluna* (heather) constitutes by far the largest part of the non-tree pollen. In sample III, on the other hand, apart from *Calluna*, Gramineae (grasses) also show a high percentage. *Triticum*- (wheat) type pollen is relatively common, and a large number of herbs are represented.

The tree pollen percentages in samples II and III agree fairly well with each other, suggesting that the difference in time between both samples could not have been very great. Sample II shows a high percentage for grasses, while the values for *Plantago lanceolata* (ribwort plantain), *Rumex* (sorrel) and *Trifolium repens* (white clover) are relatively high, indicating that before this surface became sealed off it was used as pasture land. The presence of *Triticum*-type pollen demonstrates that agriculture must have been practised in the immediate vicinity. As the humous horizon of the podzol profile on the spot of sample II was undisturbed, there cannot have been a field there at that time. It is very likely that the human activity which is clearly reflected in the pollen contents of sample II must be ascribed to the inhabitants of the Wijster settlement.

On top of this undisturbed podzol profile, a layer of arable soil was present. As this layer was cut by a foundation trench of the settlement, there can be little doubt that it was comtemporaneous with an earlier phase of the Wijster village. The fact that the podzol profile had not been disturbed by the tilling of the field suggests that cultivation there had not started before an accumulation of soil on top of the podzol

profile had taken place. It is not unlikely that the accumulation of soil on this spot was due to a local deposition of drift sand.

As for the spade mark sample IV, it is striking that in contrast to samples II and III this sample shows high percentages for *Betula* (birch), *Corylus* (hazel) and *Pinus* (pine), in consequence of which the values for the other trees are relatively low. Especially the relatively high *Pinus* percentage is very surprising. It is true that the *Corylus* percentage is not much higher than that in II and III, but without over-representation this value would have been only half of that in the last-named samples, as is the case with *Alnus* (alder) and *Quercus* (oak). An explanation for the abnormally high values for birch, hazel and pine must remain very hypothetical. If pollen of insect-pollinated plants was concerned, one could imagine that this had been brought into the soil by insects such as digger bees.[5] As birch, hazel and pine are wind-pollinated, it seems more likely that the extra pollen of these species arrived into the soil through the activity of man. In this connection it is perhaps not too absurd to ascribe the overrepresentation of the pollen types mentioned above to the effect of manuring. If the branches of these species had been used in the byre as litter, this could account for their high pollen percentages in sample IV. The fact that samples III and IV are from different fields, which would not always have been treated in the same way, could explain the difference in pollen contents of both spade mark samples. The high *Calluna* percentage in sample III could suggest that heather litter was used in the byre, although it must be kept in mind that at least a part of the *Calluna* pollen could have originated from the local heather vegetation which covered the soil before cultivation started. It should be emphasized that there are no other indications for manuring, and that only the difference in pollen contents of both spade mark samples gave occasion to this speculation.

The relatively high percentages for Cyperaceae (sedge family) in samples III and IV, as well as in samples V and VI to be discussed later, are somewhat remarkable. In samples from burial mounds Cyperaceous pollen is met with very seldom. On the dry sandy soils only a few representatives of this family are found, and these mostly in small numbers. As the Cyperaceous pollen met with in the Wijster samples is of the *Eriophorum*-type, it is most likely that this pollen originated from cotton grass which was growing on the little bog near the settlement.

Samples V and VI are distinguished from samples III and IV by, among other things, a further decrease of the *Corylus* percentages, a marked increase of *Fagus*, and the presence of *Carpinus* (hornbeam). This indicates that these samples are not inconsiderably younger than samples III and IV. The relatively high values for *Secale* provide evidence for the cultivation of rye. To all appearance this cereal crop was not cultivated in the Netherlands until the Middle Ages. The spectra of samples V and VI resemble in many respects (*Fagus*, *Carpinus*, *Corylus*, *Secale*) those of the samples from the Anglo-Saxon cemetery near Zweeloo (prov. of Drenthe), which

must be dated to the 5th–7th century A.D.[6] The arable soil of samples V and VI is very likely of early Mediaeval time. The marked differences in the pollen contents of the samples from the last phase of the settlement and those from the arable soil on top of the settlement suggest a hiatus in habitation at this site.

B. THE CARBONIZED GRAIN

Sample 1239 consists of about 250 grains. The preservation is rather poor, and moreover various grains are deformed in consequence of excessive heating. Apart from a small number that could not be studied because those grains have a coating of luted sand, the whole sample could be identified as *Hordeum* (barley). The presence of asymmetrical grains points to six-row barley (*Hordeum vulgare*). Many grains show an angular cross-section while also remnants of pales could be observed in various cases, providing good evidence for hulled barley. Because of the absence of rachis internodes it could not be determined whether the dense-eared or the lax-eared variety of the hulled six-row barley is concerned here.

Of this sample 12 grains which had preserved the radicle point were selected for measurement. The results are shown in Table 1.

TABLE I. MEASUREMENTS OF BARLEY GRAINS

	average	minimum	maximum
Length in mm.	5.9	5.1	7.1
Breadth in mm.	3.0	2.6	3.4
Thickness in mm.	2.4	2.0	2.9

The dimensions of the Wijster barley agree reasonably well with those of the hulled six-row barley found in the Dalshøj site (1st century A.D.) in Denmark.[7]

Apart from barley, wheat must also have been cultivated by the Wijster farmers, as may be concluded from the presence of *Triticum*-type pollen in the spade mark samples. Moreover, in the filling of the dug-out well 10, a handful of stem fragments of flax (*Linum usitatissimum*) was met with. These fragments remain after the braking of the flax stems to release the bast fibres.

TABLE II.

	I	II	III	IV	V	VI
Alnus (Alder)	57.8	56.0	56.7	23.6	52.3	53.4
Betula (Birch)	3.8	11.3	9.5	28.1	7.4	11.4
Corylus (Hazel)	32.6	22.8	21.0	25.7	14.5	10.2
Quercus (Oak)	2.6	3.8	6.2	2.9	10.6	10.4
Tilia (Lime)	1.1	0.5	0.3	0.2	0.2	–
Ulmus (Elm)	1.1	0.9	1.6	0.9	1.0	0.2
Fraxinus (Ash)	0.2	0.9	1.0	0.2	1.5	1.6
Fagus (Beech)	0.2	1.0	1.0	0.3	3.0	4.4
Carpinus (Hornbeam)	–	–	–	–	1.2	1.8
Acer (Maple)	–	0.1	–	0.1	–	0.4
Pinus (Pine)	0.6	1.5	1.3	16.8	1.2	0.8
Picea (Spruce)	0.1	–	–	–	–	–
Abies (Fir)	–	0.1	–	–	–	–
Salix (Willow)	–	0.9	1.3	1.0	4.7	4.8
Hedera (Ivy)	–	0.1	–	–	1.2	0.2
Rhamnus (Buckthorn)	–	–	–	–	0.5	0.2
Frangula (Alder Buckthorn)	–	–	–	–	–	0.2
Sambucus (Elder)	–	–	–	–	0.2	–
Ilex (Holly)	–	–	–	–	0.2	–
Σ AP (Tree pollen sum)	850	806	305	896	405	500
Calluna (Heather)	75.0	94.4	147.5	37.3	86.2	26.6
Ericaceae undiff. (Heath Family)	–	0.1	0.3	–	–	0.2
Cyperaceae (Sedge Family)	–	1.0	35.4	10.2	8.4	28.4
Gramineae (Grass Family)	6.2	54.3	195.0	27.6	171.5	131.0
Triticum-(Wheat) type	–	0.4	2.0	1.0	1.0	1.4
Hordeum-(Barley) type	–	–	–	–	0.5	–
Secale-(Rye) type	–	–	–	–	7.7	8.0
Cerealia undiff. (Cereals)	–	–	1.0	0.1	–	–
Plantago lanceolata (Ribwort Plantain)	0.6	2.5	0.7	0.7	10.6	3.8
Plantago major (Great Plantain)	–	–	0.3	–	–	–
Rumex (Sorrel)	–	3.7	4.6	1.3	26.9	13.2
Artemisia (Mugwort)	0.1	–	1.6	0.3	1.0	1.4
Chenopodiaceae (Goosefoot Family)	0.1	0.5	3.6	0.6	1.0	1.4
Spergula (Corn Spurry)	–	1.5	0.7	0.4	1.5	1.4
Caryophyllaceae undiff. (Pink Family)	–	0.2	0.3	0.3	0.7	0.4
Hieracium-(Hawkweed) type	0.5	1.4	6.6	1.2	25.7	3.0
Achillea-(Yarrow) type	–	0.6	0.7	0.1	1.7	1.0
Filago-(Cudweed) type	–	–	–	–	0.5	–
Tubuliflorae undiff. (Composite Family)	0.1	0.7	2.0	0.2	1.0	1.6
Potentilla-(Tormentil) type	0.1	0.4	3.6	0.9	2.0	0.2
Filipendula ulmaria (Meadow-sweet)	–	0.1	0.3	–	–	0.8
Rosaceae undiff. (Rose Family)	–	–	–	0.1	–	0.8
Anemone-(Anemone) type	0.1	–	–	0.1	–	–
Ranunculus repens-(Buttercup) type	–	0.1	–	0.3	0.5	1.8
Jasione-(Sheep's-bit) type	–	0.2	0.7	0.3	3.0	2.2

TABLE II. (continued)

	I	II	III	IV	V	VI
Campanulaceae undiff. (Bluebell Family)	–	0.1	–	–	0.2	–
Polygonum aviculare-(Knotgrass) type	–	–	1.0	0.1	1.0	0.6
Polygonum persicaria-(Persicaria) type	–	0.2	–	0.2	0.2	0.2
Cruciferae (Mustard Family)	–	0.4	3.3	0.8	2.5	5.4
Trifolium repens-(White Clover) type	–	1.1	0.3	–	0.7	1.0
Genista-(Petty Whin) type	–	0.1	–	–	–	0.2
Lathyrus-(Vetchling) type	–	–	–	–	0.2	–
Leguminosae undiff. (Pulse Family)	–	–	1.0	–	0.2	0.8
Melampyrum (Cow-wheat)	–	–	0.3	–	–	–
Scrophulariaceae undiff. (Figwort Family)	–	0.1	–	–	–	0.2
Umbelliferae (Parsley Family)	–	–	1.6	–	–	0.4
Galium-(Bedstraw) type	–	0.1	0.3	–	–	3.2
Lysimachia (Loosestrife)	–	0.1	–	–	–	–
Thymus-(Thyme) type	–	–	–	–	2.7	0.2
Erodium (Storksbill)	–	0.1	–	–	–	–
Hypericum (St. John's Wort)	–	–	0.7	–	–	0.2
Succisa pratensis (Devil's-bit Scabious)	–	–	0.3	0.1	–	0.1
Drosera rotundifolia (Sundew)	–	–	–	0.1	–	–
Lycopodium clavatum (Stags-horn Moss)	–	–	–	0.3	–	–
Pteridium aquilinum (Bracken)	0.5	0.2	0.7	1.2	–	0.2
Polypodium vulgare (Polypody)	0.1	0.1	–	–	0.2	–
Dryopteris (Shield Fern)	2.4	1.9	2.0	1.1	0.5	0.4
Sphagnum (Peat Moss)	0.6	0.2	3.9	0.2	2.7	3.8
Unidentified pollen	0.5	0.9	6.2	0.7	3.0	3.0

NOTES

[1] The author wishes to thank Mr. J. H. Wisse, Landbouwhogeschool, afd. Bosexploitatie en Boshuishoudkunde, Wageningen, for the identification of the wood of the weaving sword (Fig. 65: 1).

[2] Van Giffen 1954.

[3] Van Zeist 1954.

[4] Havinga 1962, 72–3.

[5] Havinga 1962, 69.

[6] Van Zeist 1955, 39–41.

[7] Helbaek 1952, 216.

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